Pooling safety

Electrical work in swimming pools and other water-based locations brings its own regulations – and challenges. **Graham Wretham** explains how to interpret the different zones and how each of them has to be treated differently.

The scope of this special location applies to basins of swimming pools, the basins of fountains and the basins of paddling pools. The requirements also apply to the zones surrounding these basins. Swimming pools and the like are considered to be special installations or locations because of the increased risk of shock arising from the fact that a person's body resistance is significantly reduced when wet and only partially clothed and by good contact with earth. Moreover, such locations require a higher degree of protection for equipment which is likely to be subject to water splashes or sprays.

Special requirements not only apply to the swimming pool but also to the surrounding area. Accordingly, the location is divided into three distinct zones – Zones 0, 1 and 2 – as detailed in Figure 1.

In summary, Zone 0 is the interior of the basin of the swimming pool, Zone 1 is the immediate area to the side (up to 2.0m wide) and above the pool itself (to a height of 2.5m), while Zone 2 covers the remaining area to the side of Zone 1 for a further 1.5m wide and 2.5m high.

Various protective measures (electric shock) need to be put into place for each of these zones together with the selection and erection of electrical equipment that needs to be installed in these areas of swimming pools.

Zone 0 – the interior of the swimming pool basin

Not surprisingly, there are very limited applications for the installation of electrical equipment within the swimming pool interior. A typical example of such equipment would be underwater lighting.

The protective measure against electric shock would need to be provided by SELV at a nominal voltage not exceeding 12V. Furthermore, the source of supply for this SELV circuit would need to be located outside of the surrounding zones. That is, at least 3.5m away from the edge of the pool.

Equipment selected for the interior of the basin (Zone 0) would need to be manufactured to an IP rating of IPX8, which means that the underwater lighting equipment would be able to withstand any water ingress when totally submerged with water under a pressure greater than 0.1 bar. The manufacturers' guidance on installation and suitability should be followed, and you should also confirm that the underwater luminaire complies with BS EN 60598-2-18.

Equipment used for cleaning the interior of the swimming pool basin should only be employed when people are not using the pool. Any socket outlet used for the supply of this equipment should be labelled to warn people that the pool must not be used when the cleaning equipment is in use.

Again, the protective measure against electric shock for this installation would normally be SELV, but now the nominal voltage may be increased to not exceeding 50V. However, if the supply cannot be taken from a source outside Zone 2, a 30mA residual current device (RCD) should be used to provide additional protection.

As an alternative to a SELV supply, the protective measure of automatic disconnection of the supply (which includes earthing and bonding) may be used. Again, automatic disconnection of supply would require the additional protection of a 30mA RCD.

Another alternative protective measure would be by electrical separation. Again, if the supply cannot be taken from a source outside Zone 2, a 30mA RCD should be used to provide additional protection.

Zone 1 – the area surrounding the edge of the pool for a distance of 2.0m and a height of 2.5m

The protective measure against electric shock would again need to be provided by SELV, at a nominal voltage not exceeding 50V. Furthermore, the source of supply for this SELV circuit would need to be located outside of the surrounding zones, i.e. at least 3.5m away from the edge of the pool.

Equipment selected for the immediate surrounding area to the pool (Zone 1) would need to be manufactured to an IP rating of IPX4 (splashproof) or where water jets are likely, IPX5 (jetproof). Again, the manufacturers' guidance on installation and suitability should be followed.

A problem arises for smaller swimming pools where the dimensions of the building create a situation where the external wall is built as close as 1.5m from the pool edge, typical with many domestic type swimming pool buildings that form part of an extension to the house.

In this case, the IET Wiring Regulations, BS 7671, allow a conventional BS 1363 socket outlet – providing it is non-metallic – to be installed at least 1.25m from the edge of the pool and is placed at least 0.3m from the floor. The protective measure against electric shock for this socket outlet circuit would generally be automatic disconnection of supply with the additional protection of a 30mA RCD.

Lighting circuits in Zone 1 have a similar relaxation in that such luminaires do not necessarily need the protective measure of SELV if they are installed on a wall within Zone 1 providing that the following measures are met:

- The circuit is protected by automatic disconnection of the supply and additional protection is provided by a 30mA rcd.
- The height from the floor to the luminaire is at least 2m.
- The luminaire shall have an enclosure providing Class II or equivalent insulation.
- The luminaire is protected against impact of medium severity (AG2).

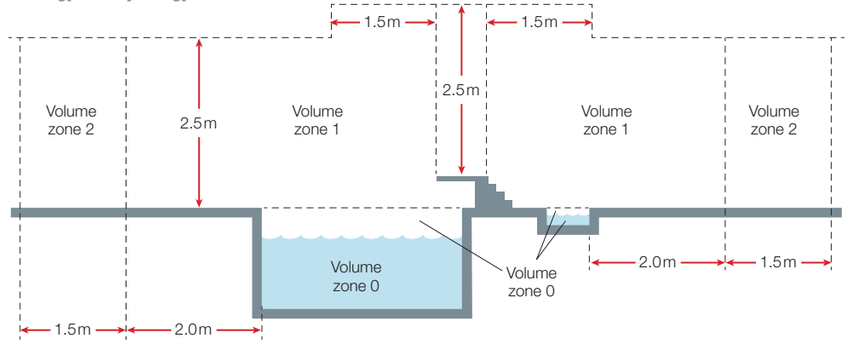
Zone 2 – the area surrounding Zone 1 for a further distance of 1.5m and a height of 2.5m

The protective measure against electric shock for electrical equipment in this zone may be any of the following:

- **SELV** at a nominal voltage not exceeding 50V. However, if the supply cannot be taken from a source outside Zone 2, a 30mA RCD should be used to provide additional protection.
- **Automatic disconnection** of the supply (which includes earthing and bonding) may be used. Again, automatic disconnection of supply would require the additional protection of a 30mA RCD. It should be noted that where a PME earthing facility is used as a means of earthing for the electrical installation of the swimming pool, it is recommended that an earth mat or earth electrode of suitable low resistance, for example 20Ω or less, be connected to the protective equipotential bonding
- **Electrical separation.** Again, if the source of supply is not able to be taken from a source outside Zone 2, a 30mA residual current device (RCD) should be used to provide additional protection.

Equipment selected for Zone 2 would need to be manufactured to an IP rating of IPX2 (drip proof) for indoor locations, IPX4 (splashproof) for outdoor locations or, where water jets are likely, IPX5 (jetproof). Again, the manufacturers' guidance on installation and suitability should be followed.

Figure 1. Zone dimensions for swimming pools and paddling pools.



The author

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Previously the NICEIC Inspecting Engineer for Kent, Graham was later promoted to Senior Engineer and was also the NICEIC's representative on various external and international technical panels. Graham gained further promotion to NICEIC Operations Manager and then, following a restructure, to Operations Director.

Graham left the NICEIC in 2005 to start his own electrical and consultancy business, Redford Charles Ltd, which has become one of the leading electrical training companies in the south east and works for a number of blue chip clients.

NOTE
It is important to remember that because the swimming pool is considered a special installation or location, due to the wet conditions, basic protection for any SELV circuit must have basic insulation or the conductors must be behind barriers and enclosures to at least IP2X.

Table 1 provides a summary of the selection of equipment for external influences.

Earthing and bonding

Unlike the special location of bathrooms and shower rooms, the IET Wiring Regulations - BS 7671 17th Edition – have not relaxed the equipotential bonding requirements for swimming pools. Accordingly, supplementary equipotential bonding shall be provided, connecting all extraneous conductive parts and exposed conductive parts in Zones 0, 1 and 2 together. Where a metal grid is installed in a solid floor, it must be connected to the local supplementary bonding.

Wiring systems

Wiring systems, surface wiring or otherwise, should preferably not employ metallic conduit, trunking or exposed metallic sheath. However, if the installation of a metallic covering or sheath is unavoidable, the sheath or covering should be connected to the supplementary bonding.

For Zones 0 and 1, a wiring system shall be limited only to equipment situated in those zones.

Other requirements

A junction box should not be installed in Zones 0 or 1, but – in the case of SELV circuits – it is permitted to install junction boxes in Zone 1.

Switchgear and control gear shall not be installed in Zones 0 or 1.

It is permitted to install an electric heating unit embedded in the floor, provided it meets one of the following conditions:

- It is protected by SELV at a nominal voltage not exceeding 50V. However, if the supply cannot be taken from a source outside Zone 2, a 30mA RCD should be used to provide additional protection.
- It incorporates an earthed metallic sheath connected to the supplementary equipotential bonding and its supply circuit is additionally protected by a 30mA RCD.
- It is covered by an embedded earthed metallic grid connected to the supplementary equipotential bonding and its supply circuit is additionally protected by a 30mA RCD.

Underwater lighting located behind portholes, and serviced from behind, must comply with the appropriate part of BS EN 60598 and be installed in such a way that no intentional (or unintentional) conductive connection between any exposed conductive part of the underwater luminaires and any conductive parts of the portholes can occur. ■

Table 1. Index of protection IP codes for general guidance.

Zone	Minimum degree of protection
0	IPX8
1	IPX4 or IPX5 for water jets likely to occur for cleaning purposes
2	IPX2 for indoor locations, IPX4 for outdoor locations and IPX5 for water jets likely to occur for cleaning purposes

TO SUM UP

- For zone 0, the protective measure against electric shock would need to be provided by SELV at a nominal voltage not exceeding 12V.
- Equipment selected for the interior of the basin (Zone 0) would need to be manufactured to an IP code of IPX8.
- For Zone 1, the protective measure against electric shock would need to be provided by SELV at a nominal voltage not exceeding 50V.
- Equipment selected for Zone 1 would need to be manufactured to an IP code of IPX4 (splashproof) or where water jets are likely, IPX5 (jetproof).
- BS 7671 allows a conventional BS 1363 socket outlet, providing it is non-metallic, to be installed at least 1.25m from the edge of the pool and at least 0.3m from the floor. The protective measure against electric shock for this socket outlet circuit would generally be automatic disconnection of supply with the additional protection of a 30mA RCD.
- Lighting circuits in Zone 1 do not necessarily need the protective measure of SELV if they are installed on a wall within the zone's dimensions providing that:
  - The circuit protected by automatic disconnection of the supply and additional protection is provided by a 30mA RCD.
  - The height from the floor to the luminaire is at least 2m.
  - The luminaire shall have an enclosure providing Class II or equivalent insulation.
  - Protected against impact of medium severity (AG2).
  - Automatic disconnection of the supply (which includes earthing and bonding) used in Zone 2 would require the additional protection of a 30mA RCD.
- Supplementary equipotential bonding shall be provided, connecting all extraneous conductive parts and exposed conductive parts in Zones 0, 1 and 2 together. Where a metal grid is installed in a solid floor, it should be connected to the local supplementary bonding.
- Wiring systems, surface wiring or otherwise, should preferably not employ metallic conduit, trunking or exposed metallic sheath.